Italian Botanist 15: 49–63 (2023)
doi: 10.3897/italianbotanist.15.102133
https://italianbotanist.pensoft.net

RESEARCH ARTICLE

Italian Botanist
Published by Società Botanica Italiana

Forest nurseries and the National Recovery and Resilience Plan: the case of Sicily and Apulia (Italy)

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Academic editor: Lorenzo Peruzzi | Received 17 February 2023 | Accepted 4 April 2023 | Published 24 April 2023

Citation: Pardi R, Venturella G, Domina G, Di Gristina E, Cirlincione F, Gargano ML (2023) Forest nurseries and the National Recovery and Resilience Plan: the case of Sicily and Apulia (Italy). Italian Botanist 15: 49–63. https://doi.org/10.3897/italianbotanist.15.102133

Abstract

In Italy, the National Recovery and Resilience Plan (NRRP) foresees the planting of *ca.* 6.6 million trees to establish urban and peri-urban forests in 14 metropolitan cities. This ambitious project requires a significant number of native trees and shrubs, currently unavailable in Italian public and private nurseries. This survey analyzes the state of forest nurseries in two administrative regions of southern Italy, i.e. the "Filici" forest nursery (province of Agrigento, Sicily) and the Gargano Mountain Reclamation Consortium (province of Foggia, Apulia), to evaluate the adequacy of Sicilian and Apulian forest nurseries as potential sources of plant material to meet the requirements of the NRRP. The census carried out at the "Filici" nursery revealed the presence of more than 22,000 seedlings in cultivation, comprising 55 species, 26 genera, and 26 families. The autochthonous species are 43 (78.2%), while the exotic ones are 12 (21.8%). The Gargano Mountain Reclamation Consortium forest nursery has 190,876 seedlings in cultivation. A total of 80 species are present, belonging to 59 genera and 32 families. Of these, 68 (85%) are native species, 12 (15%) are exotic. An analysis of the plant material being cultivated in these forest nurseries shows the presence of a share of autochthonous species of interest for urban reforestation initiatives, however these are still insufficient in number.

Keywords

Mediterranean area, native species, shrubs, southern Italy, trees

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Introduction

The Italian National Recovery and Resilience Plan (NRRP), Mission 2, Component 4, Investment 3.1 "Protection and Enhancement of Urban and Suburban Green Areas" (approved by the EU Council of Ministers on 12 January 2021) foresees a series of widescale actions. The main objectives of the Plan are: a) improve the quality of life and well-being of citizens through the protection of existing green areas and the construction of new ones; b) preserve and enhance biodiversity and ecological processes related to the full functionality of ecosystems; c) preserve and enhance biodiversity, in line with the European Biodiversity Strategy; d) contribute to the reduction of air pollution in metropolitan areas; e) reduce the number of infringement procedures, related to air quality; f) curb land consumption and restore useful soils; g) restore man-made landscapes and improve protected areas contiguous to metropolitan areas. Besides, Article 4 of Decree-Law no. 111 of October 14, 2019, transposed with amendments into Law no. 141 of December 12, 2019, defines modalities for the design of tree planting in metropolitan cities. Specifically, the Urban and Suburban Forestation Plan establishes a series of actions, focused in the 14 Italian metropolitan cities, to fight air pollution and protect biodiversity. The goal is to establish and expand urban and peri-urban forests by planting about 6.6 million trees. All the initiatives that envisage the planting of trees and new reforestation, especially in urban and peri-urban areas, represent an important driving force for the relaunch of forest nurseries.

Starting in the 1930s, the main task of Italian foresters was to reforest vast degraded areas to counteract the widespread hydrogeological instability of the territory. This situation has favored the proliferation of many forest nurseries, which provided their product free of charge, as required by almost all subsequent Forest Laws until the 1960s (Mariotti et al. 2014; Martini et al. 2022). In the 1970s, the need to reforest Italy's mountainous territory became less pressing, and many forest nurseries ceased their activities (Mariotti et al. 2014). Nowadays, there is again the need and urgency to propose reforestation and tree-planting activities. Besides, there is a marked increase in the demand for ecosystem services to combat erosion, flooding, pollution, and heat islands and for green and forested areas, especially near urban populations. The purpose of these initiatives is to increase the quality of life and to focus on issues that correlate "green" areas and health, as widely witnessed in the period of pandemic restrictions (Martini et al. 2022).

The awareness that forest nursery activity is essential for the success of any intervention aimed at environmental requalification has stimulated interest in better understanding the state of this activity in southern Italy, especially in Apulia and Sicily. Currently, in Apulia, there are 20 forest nurseries distributed in the provinces of Foggia (3), Lecce (9), Bari (5), Taranto (2), and Brindisi (1). Seven regional forest nurseries are managed by the Regional Agency for Irrigation and Forestry Activities (ARIF), while the remaining 13 are private. In 1989, the Sicilian regional government , established the "Regional Nursery Center". Currently, the Center includes 16 forest nurseries distributed in the provinces of Agrigento (4), Palermo (3), Catania (2), Enna (2), and one in each of the remaining five provinces. Each one is specialized in a specific

production. In our study, for Apulia, the forestry nursery of the Gargano Mountain Reclamation Consortium of San Marco in Lamis (province of Foggia) was examined, as it is the most representative nursery in the Regional Register, both for the abundance of forest species produced and marketed and for its internal organization. As regards the Sicilian territory, we examined the "Filici" forest nursery of Cammarata (province of Agrigento).With the establishment of the Regional Nursery Center, it has become the largest forest nursery in terms of plant production in order to meet the needs of the Sicilian Forestry Administration (Candore and Girgenti 2019).

The purpose of our survey was to analyze the plants growing in the "Filici" nursery and in that of the Gargano Mountain Reclamation Consortium and to evaluate their adequacy as a potential source of plant material to meet the needs of the NRRP.

Case study 1: The "Filici" forest nursery

The "Filici" forest nursery falls in the municipality of Cammarata (CW-Sicily) in the province of Agrigento (Fig. 1). The nursery was established in the early 1950s at the same time as the reforestation work began on the slopes of Mount Cammarata. The nursery is under the direction of the "Regional Department of Rural and Territorial Development" and is managed by the Provincial Office Service n°8 of Agrigento. Currently, the staff is represented by one forestry technician who acts as construction manager, one team leader, and three seasonal forestry workers (on a fixed-term basis) with 51, 101, and 151 working days/year depending on their category. In the past, the seasonal workers engaged reached 10 units.

The farm area covers a total of 2 ha and has an average slope of 20%. Because of the slope, the entire productive area of the nursery (1.5 ha, about 75% of the entire area) is organized in plots arranged in steps with retaining walls lined with local limestone. Irrigation is done manually or through an automated sprinkler system. The nursery's main objective is to produce plants that have genetic, morphological, and health characteristics that can offer excellent guarantees of rooting, development, and adaptability, thus ensuring success for plantings from scratch or intended for eventual reforestation on state lands. The "Filici" nursery uses seeds collected in forests located in the neighboring areas that are included in the list of "Sicilian Seed Woods" established by the Sicilian Region, which lists the forests from where seeds can be taken for forest propagation. There are two cultivation practices: with a root ball, the most widely used as the use of containers guarantees planting, and bare-root cultivation, which, however, is little used. Average annual nursery production in the past reached 400,000 seedlings; currently, due to the significant decrease in funds assigned to the nursery, it does not exceed 50,000 seedlings. The average annual mortality is estimated at 10%.

Case study 2: The Gargano Mountain Reclamation Consortium Forest

The forest nursery belonging to the Gargano Mountain Reclamation Consortium is located in San Marco in Lamis, (Borgo Celano, province of Foggia) (Fig. 1). It is a public law body under Article 59 of Royal Decree No. 215 of February 13, 1933, Article 826

Figure 1. Geographical distribution of the forest nurseries "Filici" and "Gargano Mountain Reclamation Consortium".

of the Civil Code. It was established and regulated by Presidential Decree no. 6907 of March 13, 1957. The nursery was established in 2011 and its purpose was extended to include the conservation of plant biodiversity in the Gargano area. The aim is to produce native plants for reforestation, naturalistic engineering, recovery of degraded sites, and the protection of endangered fruit species. The nursery also houses a small botanical garden of rare and endangered species of the Gargano flora, and environmental education activities can be carried out. The nursery occupies a total area of 1.1 ha, 0.5 of which is for production purposes, with a 15% slope. Currently, irrigation is done manually through direct water supply from the aqueduct, but work is ongoing to build rainwater harvesting tanks. The nursery includes an office for tadministration, a laboratory for seed processing, a teaching room, and a seed storage room. In addition, the facility comprises an archive, a laboratory for direct seeding, and a greenhouse used for growing seedlings that do not tolerate low temperatures. There is also storage for tools and two sheds for farm machinery. The latter consist of 2 backpack brush cutters, and 2 electric wheelbarrows. The workforce comprises two full-time workers, and two part-time employees. Consistent with the Regional objectives, the nursery aims to produce suitable material, especially from phytosanitary, genetic, and morphological perspectives, to try to avoid the problems related to the pathogen *Xylella fastidiosa* (Raju et al. 1986). In most cases, the plants, are destined for reforestation projects in

the Apulian territory, so the choice of forest material, and its origin, is the main factor that ensures the success of the species' establishment. Cultivation practices are root ball and bare-root. The latter, however, is little used. The average annual production is 150,000 seedlings and the average mortality is around 20%.

Material and methods

The census was carried out between spring 2021 and autumn 2022, on the basis of *in situ* surveys and observations. For each taxon, the number of cultivated seedlings was counted (Table 1). Taxa are grouped by families and ordered alphabetically. Their biological form and chorology according to Raunkiaer (1934) and Pignatti (2017, 2018, 2019) are reported. The table also distinguishes between native and exotic taxa. Nomenclature and definition of native/exotic status follows Bartolucci et al. (2018a, b, c, 2019a, b, 2020a, b, 2021a, b, 2022) and Galasso et al. (2018a, b, c, 2019a, b, 2020a, b, 2021a, b, 2022).

Results

The census carried out at the "Filici" nursery revealed the presence of 22,360 seedlings in cultivation (Table 1). The taxa with at least 1,000 specimens are *Quercus ilex* L. (5,000) and *Q. pubescens* Willd. (5,000), followed by *Cupressus sempervirens* L. (2,000), *Olea europea* L. var. *sylvestris* (Mill.) Lehr (2,000), *Abies cephalonica* Loud. (1,000), and *Pyrus spinosa* Forssk. (1,000). In the "Filici" nursery there are 55 species, belonging to 26 genera and 26 families. The most represented families are Rosaceae (11 species and 7 genera), Pinaceae (5 species and 3 genera), Fagaceae (5 species and 2 genera), Fabaceae (4 species and 4 genera), and Oleaceae (4 species and 4 genera) (Table 1). The most frequent genera are *Quercus* L. (4 species) and *Prunus* L. (3 species). The autochthonous species are 43 (78.2%), while 12 are the exotics (21.8%) (Fig. 4). Among cultivated species, the presence of *Abies nebrodensis* (Lojac.) Mattei, an endangered species and Sicilian forest endemism (Mirabile et al. 2023), is noteworthy. However, the presence in cultivation of the exotic *A. cephalonica*, present with a large number of seedlings, should be excluded as it is potentially capable of hybridizing with the endemic Sicilian fir (Raimondo and Schicchi 2005).

The Gargano Mountain Reclamation Consortium nursery has 190,876 seedlings in cultivation (Table 1). The most abundant species are *Quercus ilex* (28,654), *Q. cerris* L. (25,968), *Q. pubescens* (17,780), and *Fraxinus ornus* L. (18,292), followed by *Spartium junceum* L. (13,031), *Salix alba* L. (6,611), *Acer campestre* L. (5,544), *Pinus halepensis* Mill. (4,690), *Castanea sativa* Mill. (4,501), and *Fagus sylvatica* L. (3,779) (Table 1). A total of 80 species are present, belonging to 59 genera and 32 families. The most representative families are: Rosaceae (14 species and 7 genera), Fabaceae (5 species and 4 genera), Fagaceae (5 species and 3 genera), Lamiaceae (5 species and 4

Table 1. Taxa growing at the forest nurseries "Filici" (Nursery 1) and "Gargano Mountain Reclamation Consortium" (Nursery 2).

Taxon	No. Phytocells Nursery 1	No. Phytocells Nursery 2	Family	Biological form	Chorology	Native/ exotic
Abies cephalonica Loudon	1000	–	Pinaceae	P scap	E-Medit.	Exotic
Abies nebrodensis (Lojac.) Mattei	10	–	Pinaceae	P scap	Endemic Sicily	Native
Acer campestre L.	100	5544	Sapindaceae	P scap	Europ.-Caucas.	Native
Acer negundo L.	10	–	Sapindaceae	P scap	N-America	Exotic
Acer opalus L.	–	1419	Sapindaceae	P caesp	W-Europ.	Native
Acer pseudoplatanus L.	–	2023	Sapindaceae	P scap	Europ.-Caucas.	Native
Anagyris foetida L.	–	50	Fabaceae	P caesp	S-Medit.	Native
Arbutus unedo L.	500	200	Ericaceae	P caesp	Stenomedit.	Native
Buxus sempervirens L.	20	–	Buxaceae	P caesp	Submedit.-subatl.	Native
Carpinus betulus L.	–	971	Betulaceae	P caesp	Europ.-Caucas.	Native
Carpinus orientalis Mill.	–	245	Betulaceae	P caesp	Pontic	Native
Castanea sativa Mill.	20	4501	Fagaceae	P scap	SE-Europ. (?)	Native
Cedrus atlantica (Endl.) Carrière	50	–	Pinaceae	P scap	N-Africa	Exotic
Celtis australis L.	300	2617	Cannabaceae	P scap	Eurimedit.	Native
Ceratonia siliqua L.	20	1872	Fabaceae	P scap	S-Stenomedit.	Exotic
Cercis siliquastrum L.	100	–	Fabaceae	P scap	S-Europ.	Native
Cistus creticus L.	–	938	Cistaceae	NP	Centromedit.	Native
Citrus ×aurantium L.	50	120	Rutaceae	P scap	Asia trop.	Exotic
Colutea arborescens L.	–	50	Fabaceae	P caesp	Euri-Medit.	Native
Cornus sanguinea L.	10	1266	Cornaceae	P scap	Eurasiat.	Native
Colutea arborescens L.	–	50	Fabaceae	P caesp	Euri-Medit.	Native
Cornus mas L.	–	805	Cornaceae	P caesp	SE-Europ.-Pontic	Native
Corylus avellana L.	10	533	Betulaceae	P caesp	Europ.-Caucas.	Native
Crataegus monogyna Jacq.	500	2844	Rosaceae	P caesp	Paleotemp.	Native
Cupressus sempervirens L.	2000	50	Cupressaceae	P scap	E.-Medit.	Exotic
Cydonia oblonga Mill.	15	90	Rosaceae	P scap	SW-Asia	Native
Diospyros kaki Thunb.	–	110	Ebenaceae	P scap	E-Asiat.	Exotic
Emerus major Mill. subsp. *emeroides* (Boiss. & Spruner) Soldano & F.Conti	–	1817	Fabaceae	NP	E-Medit.-Pontic	Native
Erica multiflora L.	–	67	Ericaceae	NP	Steno-Medit.	Native
Euonymus europaeus L.	–	2634	Celastraceae	P caesp	Eurasiat.	Native
Fagus sylvatica L.	–	3779	Fagaceae	P scap	Europ.	Native
Ficus carica L.	–	28	Moraceae	P scap	Medit.-Turan.	Native
Fraxinus ornus L.	500	18292	Oleaceae	P scap	S-Europ.-Sudsib.	Native
Ilex aquifolium L.	20	420	Aquifoliaceae	P caesp	Eurimedit.	Native
Juglans regia L.	100	1390	Juglandaceae	P scap	SW-Asia	Native
Juniperus macrocarpa Sm.	–	802	Cupressaceae	P caesp	Euri-Medit.	Native
Juniperus turbinata Guss.	–	408	Cupressaceae	P caesp	W-Medit.	Native
Laurus nobilis L.	200	2050	Lauraceae	P caesp	Stenomedit.	Native
Lavandula angustifolia Mill.	20	2001	Lamiaceae	NP	Stenomedit.	Native
Ligustrum lucidum W.T.Aiton	100	–	Oleaceae	P caesp	Asia or.	Exotic
Ligustrum vulgare L.	–	1000	Oleaceae	NP	Eurasiat.	Native
Matthiola incana W.T.Aiton	20	–	Brassicaceae	Ch suffr	Stenomedit.	Native
Mespilus germanica L.	–	254	Rosaceae	P caesp	Europ.	Native
Morus alba L.	–	1	Moraceae	P caesp	E-Asiat.	Exotic
Myrtus communis L.	200	1701	Myrtaceae	P caesp	Stenomedit.	Native
Olea europea var. *sylvestris* (Mill.) Lehr	2000	262	Oleaceae	P caesp	Stenomedit.	Native
Ostrya carpinifolia Scop.	–	3113	Betulaceae	P scap	S-Europ.	Native
Paliurus spina-christi Mill.	–	40	Rhamnaceae	P caesp	SE-Europ.	Native
Phillyrea angustifolia L.	–	472	Oleaceae	P caesp	Stenomedit.	Native
Phillyrea latifolia L.	10	2000	Oleaceae	P caesp	Stenomedit.	Native

Taxon	No. Phytocells Nursery 1	No. Phytocells Nursery 2	Family	Biological form	Chorology	Native/ exotic
Pinus halepensis Mill.	100	4690	Pinaceae	P scap	Stenomedit.	Native
Pinus pinea L.	500	–	Pinaceae	P scap	Eurimedit.	Exotic
Pistacia lentiscus L.	10	1563	Anacardiaceae	P caesp	S-Stenomedit	Native
Pistacia terebinthus L.	500	2008	Anacardiaceae	P caesp	Eurimedit.	Native
Pistacia vera L.	–	1322	Anacardiaceae	P scap	E-Medit.	Exotic
Populus alba L.	–	17	Salicaceae	P scap	Paleotemp.	Native
Populus nigra L.	50	–	Salicaceae	P scap	Paleotemp.	Native
Populus tremula L.	–	26	Salicaceae	P scap	Eurosib.	Native
Prunus armeniaca L.	–	24	Rosaceae	P scap	Asiat.	Exotic
Prunus avium L.	10	–	Rosaceae	P scap	Pontic (? Europ.-Caucas.)	Native
Prunus cerasus L.	–	18	Rosaceae	P scap	Pontica	Exotic
Prunus domestica L.	–	218	Rosaceae	P caesp	SW-Asiat.	Exotic
Prunus dulcis (Mill.) D.A.Webb.	200	–	Rosaceae	P caesp	S-Europ.-Sudsib.	Exotic
Prunus mahaleb L.	–	2271	Rosaceae	P caesp	S-Europ.	Native
Prunus spinosa L.	500	1398	Rosaceae	P caesp	Europ.-Caucas.	Native
Prunus webbii (Spach) Vierh.	–	630	Rosaceae	P caesp	E-Medit.	Native
Punica granatum L.	20	1941	Lythraceae	P scap	SW-Asia	Exotic
Pyracantha coccinea M. Roem.	30	–	Rosaceae	P caesp	Stenomedit.	Native
Pyrus spinosa Forssk.	1000	3116	Rosaceae	P caesp	Stenomedit.	Native
Quercus coccifera L.	200	–	Fagaceae	P caesp	W-Stenomedit.	Native
Quercus cerris L.	–	25968	Fagaceae	P scap	Eurimedit.	Native
Quercus ilex L.	5000	28654	Fagaceae	P scap	Stenomedit.	Native
Quercus pubescens Willd.	5000	17780	Fagaceae	P scap	Europ.-Subpontic	Native
Quercus suber L.	100	–	Fagaceae	P scap	W-Eurimedit.	Native
Rhamnus alaternus L.	200	320	Rhamnaceae	P caesp	Stenomedit.	Native
Rhamnus saxatilis Jacq.	–	52	Rhamnaceae	P caesp	SE-Europ.	Native
Ribes uva-crispa L.	–	76	Grossulariaceae	NP	Eurasiat.	Native
Robinia pseudoacacia L.	100	–	Fabaceae	P scap	N-America	Exotic
Rosa canina L.	50	402	Rosaceae	NP	Paleotemp.	Native
Rosa sempervirens L.	50	–	Rosaceae	NP	W.-Medit.-Mont.	Native
Ruscus aculeatus L.	–	85	Asparagaceae	Ch frut (G rhiz)	Eurimedit.	Native
Salix alba L.	–	6611	Salicaceae	P scap	Paleotemp.	Native
Salix babylonica L.	15	–	Salicaceae	P scap	Subtrop.-Asiat.	Exotic
Salix ×fragilis L.	–	117	Salicaceae	P caesp	Eurisiber.	Exotic
Salvia officinalis L.	–	200	Lamiaceae	Ch suffr	Stenomedit.	Native
Salvia rosmarinus Spenn.	20	1540	Lamiaceae	NP	Steno-Medit.	Native
Sambucus nigra L.	–	1080	Viburnaceae	P caesp	Europ-Caucas.	Native
Smilax aspera L.	50	130	Smilacaceae	NP (G rhiz)	Paleosubtrop.	Native
Sorbus aria (L.) Crantz	500	17	Rosaceae	P caesp	Paleotemp.	Native
Sorbus domestica L.	200	114	Rosaceae	P scap	Eurimedit.	Native
Sorbus torminalis (L.) Crantz	–	442	Rosaceae	P caesp	Paleotemp.	Native
Spartium junceum L.	30	13031	Fabaceae	P caesp	Eurimedit.	Native
Stachys major (L.) Bartolucci & Peruzzi	–	30	Lamiaceae	Ch frut	Stenomedit.	Native
Tamarix africana Poir.	–	2000	Tamaricaceae	P scap	W-Medit.	Native
Tamarix gallica L.	10	–	Tamaricaceae	P caesp	W-Stenomedit.	Native
Teucrium fruticans L.	–	1026	Lamiaceae	NP	Stenomedit.	Native
Thymus vulgaris L.	20	–	Lamiaceae	Ch frut	Stenomedit.	Native
Tilia cordata Mill.	10	–	Malvaceae	P scap	Europ.-Caucas.	Native
Tilia platyphyllos Scop.	–	161	Malvaceae	P caesp	Europ.-Caucas.	Native
Ulmus minor Mill.	–	26	Ulmaceae	P caesp	Europ.-Caucas.	Native
Viburnum tinus L.	–	2905	Viburnaceae	P caesp	Stenomedit.	Native
Ziziphus jujuba Mill.	–	88	Rhamnaceae	P caesp	E-Asiat.	Exotic

Figure 2. View of the nursery "Filici" (Cammarata, province of Agrigento).

Figure 3. View of the nursery "Gargano Mountain Reclamation Consortium" (Borgo Celano, province of Foggia).

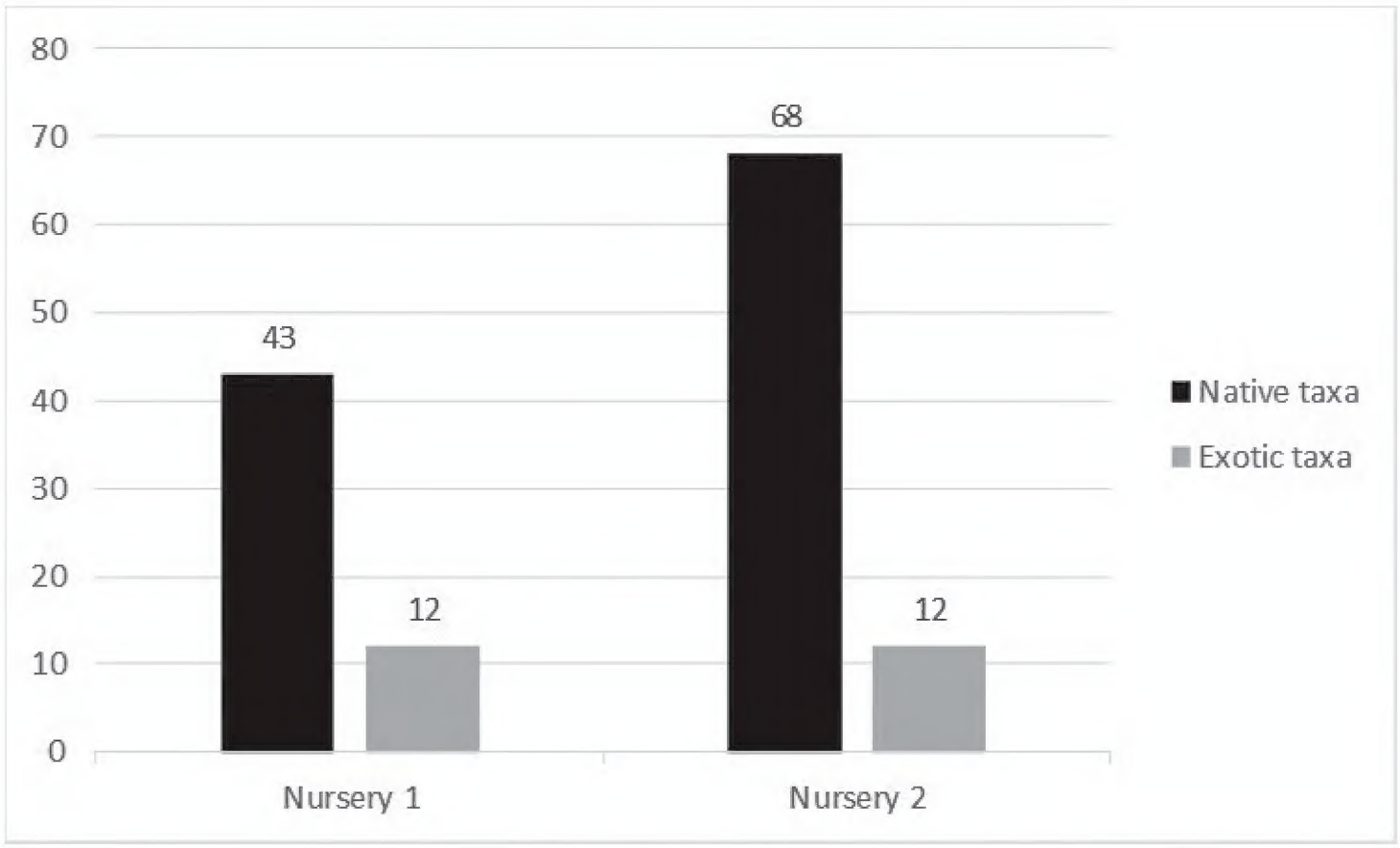

Figure 4. Number of native and exotic taxa cultivated at "Filici" (Nursery 1) and "Gargano Mountain Reclamation Consortium" (Nursery 2).

genera), and Oleaceae (5 species and 4 genera). *Prunus* (6 species), *Acer* L. (3), *Quercus* (3), and *Sorbus* L. (3) are the most frequent genera (Table 1). The autochthonous taxa are 68 (85%), while the exotic ones are 12 (15%) (Fig. 4).

In both nurseries, native species clearly dominate over exotic ones. Most of the latter are not invasive and, indeed, have a long list of traditional uses of ethnobotanical interest (*Citrus ×aurantium*, *Diospyros kaki*, *Morus alba*, *Punica granatum*, *Ziziphus jujuba*, etc.). However, alongside these taxa, there are others, such as *Acer negundo*, *Ligustrum lucidum*, and *Robinia pseudoacacia* capable of becoming invasive if planted in natural areas. It would be advisable to stop the production of these three species.

The age of the plants produced in the two forest nurseries range from 1 to 5 years old and, overall, the phytosanitary status of the plants is good.

Discussion

A few decades after the first plantings, forest nursery production began to have difficulties in maintaining native forest biodiversity. The most important reason for these failures is the use of allochthonous genotypes of unproven adaptability (Mariotti et al. 2014). In fact, for the proper implementation of reforestation, forest reconstitution of degraded forest stands, and wood arboriculture plantings, the quality of the forest propagation material to be used is crucial (Konnert et al. 2015).

These activities require the use of plant material adapted to the microclimatic and soil conditions of individual localities. This also helps to preserve biodiversity, enhance

taxonomic entities and ecotypes of high genetic value, safeguard endangered species, and avoid genetic pollution. In this regard, forest nurseries play an important role as they should meet this requirement by supplying seedlings produced from seed of native origin.

Despite the awareness of the importance of forest nurseries, in recent years in Italy, there has been a progressive disinterest and abandonment of this activity as part of an ill-advised forestry policy undertaken by regional governments. Urban reforestation, within the actions of the Italian Recovery Fund, is the bet for the future of Italian cities and for the quality of life of the next generations. It will be necessary to overcome the difficulties in finding areas for reforestation in urban areas (lack of political sensitivity, constraints, etc.).

The number of native plants useful for reforestation kept in nursery stocks is still quite limited, partly due to the drastic reduction of regional nurseries and qualified personnel. It is, therefore, necessary to know the current stock of existing nurseries and implement the number of native species for more effective actions in the territory.

The analysis of the two forest nurseries in Sicily and Apulia showed that the available species meet the reforestation plan requirements. In fact, the propagated plant material comes entirely from local autochthonous populations, thus guaranteeing the availability of genotypes that are adapted to the environment in which they will be used and able to cope with the predicted climate change (Selvi et al. 2023). However, although qualitatively adequate, the plant material produced is still quantitatively insufficient to respond to the ever-increasing demands that have arisen following the current "green-oriented" policy.

Acknowledgments

This study was carried out under Action IV.6 "Research Contracts on GREEN Themes – Ministerial Decree 1062/2021 and Ministerial Decree August 10, 2021, No. 1061, PON "Research and Innovation" Resources 2014-2020.

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